

ABSTRACT

An apparatus to treat an influent solution comprising ions to obtain a selectable ion concentration in an effluent solution. The apparatus comprises an electrochemical cell comprising a housing comprising first and second electrodes. A water-splitting ion exchange membrane is between the first and second electrodes, the membrane comprising an anion exchange surface facing the first electrode, and a cation exchange surface facing the second electrode, or vice versa. The housing also has an influent solution inlet and an effluent solution outlet with a solution channel that allows influent solution to flow past both the anion and cation exchange surfaces of the water-splitting ion exchange membrane to form the effluent solution. A variable voltage supply is capable of maintaining the first and second electrodes at a plurality of different voltages during an ion exchange stage.